UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/587,493 | 01/29/2007 | Daniel Pulu Poenar | 7699P008 | 8324 |

8791 7590 05/24/2011

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

| EXAMINER | |
|---|---|
| QUINTO, KEVIN V | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2829 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 05/24/2011 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/587,493 | POENAR ET AL. | |
| | Examiner | Art Unit | |
| | KEVIN QUINTO | 2829 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *04 March 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-26 and 28-41* is/are pending in the application.

4a) Of the above claim(s) *5,9-27 and 29-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-8,28,32-35 and 39-41* is/are rejected.

7)☒ Claim(s) *36-38* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3, 4, and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Wade (USPN 4,241,358).

3. In reference to claim 1, Wade (USPN 4,241,358) discloses a device which meets the claim. Figure 2 of Wade discloses a semiconductor device comprising a substrate having a surface. There is a first pn-junction (14, 12) defining a first depletion region formed on the substrate at a first depth relative to the surface. There is a second pn-junction (34, 12) defining a second depletion region formed on the substrate at a second depth relative to the surface deeper than the first depth. A doped, photo-conductive channel is formed on the substrate between the first and second pn-junctions. Patrin (USPN 3,985,449) discloses that it is well known that different colors or wavelengths of radiation penetrate to different depths in the semiconductor (column 1, lines 50-57). Thus the first and second depths inherently generate charge carriers in the first depletion region in response to light of a first wavelength band incident on the surface as well as charge carriers in the second depletion region in response to light of a second wavelength band incident on the surface in addition to charge carriers in the

channel in response to light of a third wavelength band incident on the surface. There are doped drain (20) and source (16) regions on the substrate in communication with the channel. There are first (18) and second (22) electrical interconnects in communication with the source (16) and drain (20) regions respectively. There are third (24) and fourth (32) electrical interconnects in communication with the first and second pn-junctions respectively. Incident light on the surface at the first, second, and third wavelength bands are detectable through currents through said first, second, third and fourth electrical contacts.

4. In reference to claim 3, the substrate comprises a wafer while the channel (12) is on the wafer. Wade does not disclose that the channel is epitaxially grown. However this places the claim into the form of a **product-by-process claim**:

> Note that a "product by process" claim is directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Thorpe,* 227 USPQ 964, 966; *In re Luck*, 177 USPQ 523; *In re Fessmann*, 180 USPQ 324; *In re Avery*, 186 USPQ 161*; In re Wertheim*, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and *In re Marosi* et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in " product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above case law makes clear. See also MPEP 2113.

Claim 3 is not patentably distinguishable from the Wade reference regardless of the process used to form the channel, because only the final product is relevant, and not the process of making such as epitaxial growth.

5. With regard to claim 4, the electrical interconnects (18, 24, 22, and 32) and the surface are on the same side of the substrate.

6. In reference to claim 6, there is a top gate region (14) adjoining the channel forming the first pn-junction and a bottom gate region (30) adjoining the channel forming

the second pn-junction. The channel is doped of a first conductive type while the gate regions (14, 30) are doped of an opposite, second conductive type, thus forming a junction field-effect transistor (JFET) on the substrate.

7. Claims 1, 3, 4, 6, 32-35, 39, and 41 are rejected under 35 U.S.C. 102(b) as being anticipated by Wolffenbuttel (USPN 4,749,851).

8. In reference to claim 1, Wolffenbuttel (USPN 4,749,851) discloses a device which meets the claim. Figures 11a-11b, 14a-14b, 15a-15b, and 16a-16b disclose a semiconductor device comprising a substrate having a surface. There is a first pn-junction defining a first depletion region formed on the substrate at a first depth relative to the surface. There is a second pn-junction defining a second depletion region formed on the substrate at a second depth relative to the surface deeper than the first depth. A doped, photo-conductive channel (13, 31, 71, 91, 102) is formed on the substrate between the first and second pn-junctions. The first and second depths are chosen to generate (i) charge carriers in the first depletion region in response to light of a first wavelength band incident on the surface, (ii) charge carriers in the second depletion region in response to light of a second wavelength band incident on the surface, and (iii) charge carriers in the channel in response to light of a third wavelength band incident on the surface (see abstract). There are doped drain (16, 36, 76, 96, 109) and source (15, 35, 75, 95, 108) regions on the substrate in communication with the channel. There are first (20, 40, see solid black blocks on elongated regions in all other figures) and second (19, 39, see solid black blocks on elongated regions in all other figures) electrical interconnects in communication with the source (15, 35, 75, 95, 108) and drain (16, 36,

76, 96, 109) regions respectively. There are third (21, 41a-41c, see also solid black blocks) and fourth (18, 38, see also solid black blocks) electrical interconnects in communication with the first and second pn-junctions respectively. Incident light on the surface at the first, second, and third wavelength bands are detectable through currents through the first, second, third and fourth electrical contacts.

9. In reference to claim 3, the substrate is a semiconductor wafer with the channel being epitaxially grown on the wafer (column 9, lines 50-56).

10. With regard to claim 4, the electrical interconnects and the surface are on the same side of the substrate.

11. In reference to claim 6, there is a top gate region (13) adjoining the channel forming the first pn-junction and a bottom gate region (17) adjoining the channel forming the second pn-junction. The channel is doped of a first conductive type (n-type) while the gate regions (14, 17) are doped of an opposite, second conductive type (p-type), thus forming a junction field-effect transistor (JFET) on the substrate.

12. In reference to claim 32, Wolffenbuttel (USPN 4,749,851) discloses a method which meets the claim. Figures 5a-5b, 11a-11b, 14a-14b, 15a-15b, and 16a-16b of Wolffenbuttel disclose a method of photo-sensing which comprises biasing a junction field effect transistor (JFET) to generate a conducting channel between a source (15, 35, 75, 95, 108) and a drain (16, 36, 76, 96, 109) of the JFET. The conducting channel has an absorption section below a light-transmitting surface of the JFET. The absorption section has a pre-determined photo-conductivity spectral response and at least two depleted regions (noted by the dotted lines within the substrate) below the

light-transmitting surface which each has a photo-electric spectral response peaking at a distinct, pre-determined wavelength (column 10, lines 24-41). The light-transmitting surface is illuminated with light. An output signal is sensed which is derived from the channel indicative of the intensity of absorbed light. For each particular one of the depleted regions, an output signal is sensed which derived from the particular depleted region indicative of the intensity of absorbed light (column 6, lines 21-69, column 7, lines 1-67, column 8, lines 1-68, column 9, lines 1-32, column 11, lines 37-68, column 12, lines 1—8, column 13, lines 1-60).

13. With regard to claim 33, the one or more depleted regions comprise two depleted regions at different depths below the light-transmitting surface.

14. In reference to claim 34, the sensing of the output signal comprises sensing a current (abstract, column 7, lines 25-28).

15. With regard to claim 35, the sensing of an output signal comprises sensing a drain-source current from the drain to the source through the conducting channel while the sensing of an output signal derived from the particular depleted region comprises sensing a gate current from a gate (13) in contact with the particular depleted region.

16. In reference to claim 39, pre-determined wavelengths are selected such that a plurality of different spectral components of the light can be determined from the output signals. These spectral components comprise blue, green, and red components (column 3, lines 19-23).

17. With regard to claim 41, figure 2b discloses the detection of a blue component which covers wavelengths below about 500 nm. Figure 3 also discloses the detection

of a blue component which covers wavelengths below about 500 nm, as well as a green component which covers wavelengths from about 500 to about 600 nm, and a red component which covers wavelengths above about 600 nm.

### *Claim Rejections - 35 USC § 103*

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

19. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wade (USPN 4,241,358) in view of Patrin (USPN 3,985,449).

20. In reference to claim 2, Wade does not disclose the exact depths for the first and second pn junctions. However Patrin (USPN 3,985,449) makes it clear that the depth is result effective variable since different colors or wavelengths of radiation penetrate to different depths in a semiconductor (column 1, lines 50-57). It would have been obvious to one having ordinary skill in the art at the time of the invention was made to adjust the depths of the first and second pn junctions, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Therefore this claim is not patentable over Wade and Patrin.

21. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wade (USPN 4,241,358)

22. With regard to claim 7, the first conductive type is n-type. Wade does not disclose the exact doping concentrations for the channel, the top gate, and the bottom gate. However:

> "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Thus claim 7 is not patentable over Wade.

23. With regard to claim 8, the source (16) and drain (20) regions are of the first conductive type. Wade does not disclose the exact doping concentrations for the source and the drain regions. However:

> "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Thus claim 8 is not patentable over Wade.

24. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wade (USPN 4,241,358) in view of Kuijk et al. (USPN 6,157,035).

25. In reference to claim 28, Wade does not disclose forming a plurality of photo-sensing units shown in figure 2 to form a photo-sensing device. However Kuijk et al. (USPN 6,157,035, hereinafter referred to as the “Kuijk” reference) discloses the known use of a plurality of photo-sensing units to form a photo-sensing device (column 1, lines 13-67, column 2, lines 1-12). Furthermore Kuijk makes it clear that faster turn-off times are desired in photo-sensing devices (column 2, lines 19-20). Wade makes it clear that the photo-sensing unit in figure 2 has the benefit of a fast turn-off time (column 1, lines 40-42). In view of Kuijk, it would therefore be obvious to use a plurality of the photo-sensing units shown in figure 2 of Wade to form a photo-sensing device.

26. Claim 2, 7, 8, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolffenbuttel (USPN 4,749,851).

27. In reference to claim 2, Wolffenbuttel does not disclose the exact depths for the first and second pn junctions. However Wolffenbuttel makes it clear that the depth is result effective variable since different colors or wavelengths of radiation penetrate to different depths in a semiconductor (figures 2b, 2c, and 3, also column 5, lines 19-28). It would have been obvious to one having ordinary skill in the art at the time of the invention was made to adjust the depths of the first and second pn junctions, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Therefore this claim is not patentable over Wolffenbuttel.

28. With regard to claim 7, the first conductive type is n-type. Wolffenbuttel does not disclose the exact doping concentrations for the channel, the top gate, and the bottom gate. However:

> "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Thus claim 7 is not patentable over Wolffenbuttel.

29. With regard to claim 8, the source and drain regions are of the first conductive type. Wolffenbuttel does not disclose the exact doping concentrations for the source and the drain regions. However:

> "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Thus claim 8 is not patentable over Wolffenbuttel.

30. In reference to claim 28, Wolffenbuttel does not disclose forming a plurality of photo-sensing units to form a photo-sensing device. However it would have been obvious to one having ordinary skill in the art at the time the invention was made to form more than one photo-sensing unit, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. Mere duplication of parts has no patentable significance unless a new and unexpected result is produced. In re Harza, 274 F.2d 669, 124 USPQ 378 (CCPA 1960). Thus claim 28 is not patentable over Wolffenbuttel.

### *Allowable Subject Matter*

31. Claims 36-38 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

32. The following is a statement of reasons for the indication of allowable subject matter: the allowable subject matter was discussed in the previous Office action.

### *Response to Arguments*

33. Applicant's arguments filed October 7, 2010 and March 4, 2011 have been fully considered but they are not persuasive. In the response filed on October 7, 2010, the applicant argues that Wade (USPN 4,241,358) does not disclose a semiconductor device with first and second pn junctions with respective depletion region depths that are chosen to generate charge carriers in the photo-conductive channel in response to

light of a third wavelength band. However as explained in the previous Office action (as well as above), different colors and wavelengths of radiation penetrate to different depths in the semiconductor; thus the first and second depths inherently generate charge carriers in the first depletion region in response to light of a first wavelength band incident on the surface as well as charge carriers in the second depletion region in response to light of a second wavelength band incident on the surface in addition to charge carriers in the channel in response to light of a third wavelength band incident on the surface. Although the applicant argues that the claim describes a structure in which the first and second depths are “chosen" to generate free carriers, the above Office action makes it clear that there is no structural difference between a device having the first and second depths which are “chosen" to generate free carriers and a device having the first and second depths which inherently generate charge carriers for two different wavelengths of light. The applicant also argues that Wade does not disclose a doped photo-conductive channel because the photo-conductive channel of Wade has no "active role in photo detecting.” This argument fails to be persuasive since limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Although the applicant discusses (p. 16-19 of the response filed on October 7, 2010) the JFET operation of Wolffenbuttel (USPN 4,749,851), there are no specific remarks, in terms of how the claim language avoids or is distinguishable from the Wolffenbuttel reference, which support the argument (p. 19 of the response filed on October 7, 2010) that Wolffenbuttel fails "to disclose a doped, photo-conductive channel formed on said substrate between said first and second pn-

junctions, said first and second depths chosen to generate charge carriers in said first depletion region in response to light of a first wavelength band incident on said surface, generate charge carriers in said second depletion region in response to light of a second wavelength band incident on said surface, and generate charge carriers in said channel in response to light of a third wavelength band incident on said surface, doped drain and source regions on said substrate in communication with said channel as recited in claim 1." In addition, the applicant argues (p. 16-19 of the response filed on October 17, 2010 and the response filed on March 4, 2011) that Wolffenbuttel does not use the complete JFET structure to perform complete colour sensing, does not simultaneously detect all colour signals, and that it cannot be considered a true colorimetric sensor. However claim 32 does not claim such processes or methods. The applicant argues (in the response filed on October 17, 2010 and March 4, 2011) that Wolffenbuttel describes "only two depleted regions" and not "at least two" as required by claim 32. However the examiner would like to point out that a structure with "at least two depleted regions" does not exclude a structure with only two depleted regions. Furthermore the previous Office action (and the above Office action) makes it clear that the structures of figures 5a-5b, 11a-11b, 14a-14b, 15a-15b, and 16a-16b of Wolffenbuttel have at least two depleted regions. The applicant also argues (p. 20 of the response filed on October 17, 2010) that, "…Wolffenbuttel has not provided any evidence that charge carriers would be generated in a second depletion region in response to wavelengths incident on a second surface or in a channel based on wavelengths incident on a channel." The examiner respectfully disagrees since

Wolffenbuttel discloses the use of the depleted regions and their depths to detect multiple wavelengths (column 6, lines 21-69, column 7, lines 1-67, column 8, lines 1-68, column 9, lines 1-32, column 11, lines 37-68, column 12, lines 1-8, column 13, lines 1-60). The applicant also argues (in the response filed on March 4, 2011) that Wolffenbuttel does not disclose that for each particular one of said depleted regions, an output signal derived from said particular depleted region is sensed and that the output signal is indicative of the intensity of light absorbed therein. However Wolffenbuttel makes it clear that an output signal indicative of the absorbed light in each depleted region is measured (column 6, lines 21-69, column 7, lines 1-67, column 8, lines 1-68, column 9, lines 1-32, column 11, lines 37-68, column 12, lines 1-8, column 13, lines 1-60). Although the applicant argues (in the response filed on March 4, 2011) that claim 32 requires a structure in which the two depleted regions each have a photoelectric response that peaks at a "distinct, pre-determined wavelength," Wolffenbuttel inherently meets this limitation (column 10, lines 24-41). Therefore claims 1-4, 6-8, 28, 32-35, and 39-41 stand rejected.

## ***Conclusion***

34. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEVIN QUINTO whose telephone number is (571)272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ha Nguyen can be reached on (571) 272-1678. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kevin Quinto/

Examiner, Art Unit 2829

/HA TRAN T NGUYEN/
Supervisory Patent Examiner, Art Unit 2829